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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/529,238	03/25/2005	Takashi Arakane	OHTN:023	2552

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EXAMINER	
CROUSE, BRETT ALAN	
ART UNIT	PAPER NUMBER
1794	

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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)	
	10/529,238	ARAKANE ET AL.	
	Examiner	Art Unit	
	Brett A. Crouse	1794	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE *3* MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *08 December 2008*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-16* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-16* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☒ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date *20080815*.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

1. This office action is in response to the amendment, filed 8 December 2008, which amends claims 1 and 2 and adds new claim 16. Claims 1-16 are pending.

Response to Amendment

2. The rejection(s) of:

claims 1, 2, 4, 6-10 and 14 under 35 U.S.C. 102(b) as being anticipated by Okada et al., US 2002/055014;

claim 3 under 35 U.S.C. 103(a) as being unpatentable over Okada et al., US 2002/055014, as evidenced by Matsushima et al., Current Applied Physics, (2005), Volume 5, Pages 305-308, and further in view of Hung et al., US 6,137,223;

claim 5 under 35 U.S.C. 103(a) as being unpatentable over Okada et al., US 2002/055014, as evidenced by Matsushima et al., Current Applied Physics, (2005), Volume 5, Pages 305-308, and further in view of Adachi et al., Organic Electronics, (2001), Volume 2, Pages 37-43;

claims 11-13 under 35 U.S.C. 103(a) as being unpatentable over Okada et al., US 2002/055014, as evidenced by Matsushima et al., Current Applied Physics, (2005), Volume 5, Pages 305-308, and further in view of Okada 6,656,612;

and

claim 15 under 35 U.S.C. 103(a) as being unpatentable over Okada et al., US 2002/055014, as evidenced by Matsushima et al., Current Applied Physics, (2005), Volume 5, Pages 305-308

are overcome by the amendment, filed 8 December 2008.

Claim Rejections - 35 USC § 103

3. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

4. Claims 1, 2, 3, 4, 6, 7, 8, 9, 10, 14, 15, 16 are rejected under 35 U.S.C. 103(a) as being unpatentable over Shirasaki et al., US 5,834,894, in view of Okada et al., US 2002/055014, with further evidence provided by Matsushima et al., Current Applied Physics, (2005), Volume 5, Pages 305-308, and Bernede et al., SCELL-2004 International Conference on Physics, Chemistry and Engineering of Solar Cells, Badajoz, Espagne(13/05/2004), (2005), Volume 87, Number 1-4, Pages 261-270, (Abstract) and Wu et al., Advanced Materials, (2008), Volume 20, Pages 2359-2364.

Shirasaki teaches:

As to claims 1, 2, 4, 6, 8, 9, 10, 16:

Column 7, lines 53-58, figure 9, teach an electroluminescent device comprising a hole transport layer, light emitting layer and electron transport layer directly upon the light emitting layer.

Column 11, lines 57-65, figure 19, teach an electroluminescent device comprising a hole transport layer, a light emitting layer which further comprises poly(vinylcarbazole) and a fluorescent dopant, and an electron transport layer directly upon the light emitting layer comprising Alq3.

As to claim 3:

Column 12, lines 5-58, teach a conductive layer which is liable to be oxidized, (a reductive material), between the electron transport layer and cathode.

Shirasaki does not recite:

Shirasaki does not recite a phosphorescent light emitting dopant. Shirasaki also does not recite materials other than PVK as a host material.

Instant Specification as evidence:

Table 1, page 88, teach the properties of Alq. One of ordinary skill in the art would expect the Alq3 used by Shirasaki to also possess such properties.

Wu et al., as evidence:

Page 2359, column 1, teaches the triplet energy of poly(vinylcarbazole) (PVK) is 2.5 eV.

Bernede et al., Scell-2004 (Abstract) as evidence:

Scell-2004 (Abstract), teaches the HOMO and LUMO of poly(vinylcarbazole) (PVK) are 5.7 eV and 2.2 eV respectively.

Matsushima et al., as evidence:

Matsushima, page 307, column 2, paragraph 1, and figure 6, teaches CBP electron mobility of 10^{-4} cm^2/Vs.

Okada teaches:

Paragraphs [0236]-[0238], example 1, table 1, teaches electroluminescent devices comprising a light emitting layer having the compositions shown in table 1 and an Alq_3 electron transport layer deposited thereupon. Compositions of the light emitting layer include CBP, devices 101 and 102, as host and a phosphorescent light emitting material, K-1 and K-6, the structures of which are shown in paragraph [0214]. The properties of CBP and Alq are taught in Table 1, page 88, of the instant specification.

Paragraphs [0244]-[0246], example 3, table 3, teach electroluminescent device 301, comprising a hole transport layer, a light emitting layer which further comprises poly(vinylcarbazole) and a phosphorescent dopant K-1, $(Ir(ppy)_3)$. The passage also teaches the use of compound 63 as the host material, an imidazopyridine. It is noted that compound 3 also provides a benzimidazole. The exemplified materials contain numerous compounds comprising a carbazole group bonded via an arylene group to a benzimidazole/imidazopyridine group. Pages 12-13 of the instant specification describe as formula (I) with n=1 a carbazole bonded via an arylene group to a benzimidazole/imidazopyridine group as preferred groups. The instant specification also teaches the ionization potential of 5.6 eV to 5.8 eV. Given this teaching of the preferred groups of the instant specification opposite the structure of compound 63, in the absence

of unexpected results the compound would be expected to possess the properties as per the limitations of instant claims 1, 2, 7, 16.

Paragraphs [0217] and [0227]-[0232], teach a hole transport layer, electron transport layer and electron injection layer. The passage additionally teaches the functions of hole blocking and electron blocking are optional.

Paragraph [0004], teaches phosphorescent dopants, such as $Ir(ppy)_3$, provide improved quantum efficiency.

Paragraphs [0206]-[0214], teach preferred phosphorescent compounds. Paragraph [0213], teaches K-1, ($Ir(ppy)_3$), and complexes having the partial structure thereof are preferred.

Statement of Obviousness:

It would have been obvious to one of ordinary skill in the art to use the phosphorescent dopants of Okada in the device of Shirasaki to realize the improved efficiency as suggested by Okada. It would have been obvious to use the materials of Okada such as compound 63, as the host material in the device of Shirasaki to realize the improved performance when used to replace PVK as taught by Okada. It would have been obvious given the teachings of the material properties of the supporting references to expect the resulting device to possess the interrelationship of properties between the layers as contemplated by applicant.

5. Claim 5 is rejected under 35 U.S.C. 103(a) as being unpatentable over Shirasaki et al., US 5,834,894, in view of Okada et al., US 2002/055014, with further evidence provided by Matsushima et al., Current Applied Physics, (2005), Volume 5, Pages 305-308, and Bernede et

al., SCELL-2004 International Conference on Physics, Chemistry and Engineering of Solar Cells, Badajoz, Espagne(13/05/2004), (2005), Volume 87, Number 1-4, Pages 261-270, (Abstract) and Wu et al., Advanced Materials, (2008), Volume 20, Pages 2359-2364, as applied to claims 1, 2, 3, 4, 6, 7, 8, 9, 10, 14, 15, 16 above, and further in view of Adachi et al., Organic Electronics, (2001), Volume 2, Pages 37-43.

The teachings of Shirasaki as in the rejection above are relied upon.

Shirasaki does not teach:

Shirasaki does not teach a relationship between the triplet energy level of the hole transport layer material and the triplet energy levels of the phosphorescent dopant of the light emitting layer.

Adachi teaches:

Pages 40-41, teach energy is transferred from the MTDATA hole transport layer material into the $Ir(ppy)_3$ dopant in the adjacent light emitting layer. The triplet energy of MTDATA is greater than the triplet energy of $Ir(ppy)_3$ resulting in improved device performance by improved triplet exciton confinement.

Statement of Obviousness:

It would have been obvious to one of ordinary skill in the art to select a hole transport material having a triplet energy greater than that of the phosphorescent dopant in the adjacent light emitting layer of the device of Shirasaki in order to improve device performance by improving exciton confinement as suggested by Adachi.

6. Claims 11-13 are rejected under 35 U.S.C. 103(a) as being unpatentable over Shirasaki et al., US 5,834,894, in view of Okada et al., US 2002/055014, with further evidence provided by Matsushima et al., Current Applied Physics, (2005), Volume 5, Pages 305-308, and Bernede et al., SCELL-2004 International Conference on Physics, Chemistry and Engineering of Solar Cells, Badajoz, Espagne(13/05/2004), (2005), Volume 87, Number 1-4, Pages 261-270, (Abstract) and Wu et al., Advanced Materials, (2008), Volume 20, Pages 2359-2364, as applied to claims 1, 2, 3, 4, 6, 8, 9, 10, 16 above, and further in view of Okada 6,656,612.

The teachings of Shirasaki / Okada '014 as in the rejection above are relied upon.

Shirasaki / Okada '014 does not recite:

Shirasaki / Okada '014 does not provide an example of an electron transport layer in which an exemplified compound of formula 1 Okada '014 is used. Okada '014 does teach various heterocyclic derivatives are useful as electron transport materials including Alq as used in Shirasaki.

Okada '612 teaches:

Column 2, line 34 through column 6, line 4, formulae (I – XI), teach nitrogen containing heterocyclic compounds useful in electroluminescent devices.

Column 6, lines 33-51, provide examples of condensed rings of the various formulae.

Columns 8 through 12, teach various linking groups including naphthalene and anthracene as required by claim 12.

Column 93, lines 45-63, examples 5 and 6, teach exemplified compounds 21 and 18 in the electron transport layer. The compounds meet the limitations of claims 11 and 13.

Statement of Obviousness:

It would have been obvious to one of ordinary skill in the art to use the compounds of Okada '612 in the electron transport layer of the device of Shirasaki / Okada '014 with the expectation that the resulting layer of the device of Shirasaki / Okada '612 would exhibit suitable properties and efficient device operation as observed in Okada '612.

7. Claim 2 is rejected under 35 U.S.C. 103(a) as being unpatentable over Fujino et al., JP 2000-169448, in view of Okada et al., US 2002/055014, as evidenced by Tanaka et al., Japan Journal of Applied Physics, (2003), Volume 42, Pages 2737-2740.

Fujino teaches:

Abstract and paragraph [0001], teach compounds of formula (I) as charge transfer or light emitting materials. The passage additionally teaches the compounds of formula (I) are useful in electroluminescent devices.

Paragraphs [0032], [0033], [0038], [0039], [0040], compounds (5), (10), (11), (39), (45), (51), teach compounds of formula (I) comprising one or more carbazole groups linked to a pyridine ring via an arylene group. In the absence of unexpected results the compounds are expected to possess properties meeting the host material limitations due to their close similarity in structure to exemplified structure PB-102 of the instant invention.

Paragraphs [0082]-[0083], teach a luminescent dopant added to the light emitting layer.

Paragraphs [0069]-[0072], drawings 1-4, teach electroluminescent device structures.

Paragraph [0118], teaches OXD-7 as the electron transport material in an electroluminescent device example.

Tanaka as evidence:

Page 2739, column 1, lines 27-29, teach the triplet energy of OXD-7 is 2.7 eV.

Fujino does not teach:

Fujino does not teach the use of a phosphorescent dopant in the light emitting layer.

Okada teaches:

Paragraph [0004], teaches phosphorescent dopants, such as $Ir(ppy)_3$, provide improved quantum efficiency.

Paragraphs [0206]-[0214], teach preferred phosphorescent compounds. Paragraph [0213], teaches $Ir(ppy)_3$, K-1 and complexes having the partial structure thereof are preferred.

Statement of Obviousness:

It would have been obvious to one of ordinary skill in the art to use a phosphorescent dopant of Okada, such as preferred compound $Ir(ppy)_3$, in the device of Fujino in order to achieve improved quantum efficiency in the device of Fujino.

Response to Arguments

8. Applicant's arguments have been fully considered but they are not persuasive.

Applicant argues that the Okada '014 reference should not be combined with a reference to teach a phosphorescent dopant if the primary reference teaches only a fluorescent dopant and is without a hole blocking layer. The examiner respectfully disagrees. The disclosure of Okada does not require a hole blocking layer in the device and additionally provides experimental

examples including PVK and a phosphorescent dopant in a device in which no hole blocking layer is provided.

9. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Contact Information

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Brett A. Crouse whose telephone number is (571)-272-6494. The examiner can normally be reached on Monday - Friday.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, D. Lawrence Tarazano can be reached on 571-272-1515. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/B. A. C./
Examiner, Art Unit 1794

/D. Lawrence Tarazano/
Supervisory Patent Examiner, Art Unit 1794